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ABSTRACT

As part of the Longitudinal Study of Children at Risk, this study evaluated the Child Parent Center (CPC) Program, a preschool to third grade intervention program funded by the Elementary and Secondary Education Act (ESEA) Chapter I. Subjects were 915 low-income black children from 20 inner-city schools who were differentially exposed to school-based, comprehensive service components for up to 6 years. The comparison group consisted of 191 children who received only an all-day kindergarten program. The following six outcomes, measured in grades three through five, were used to evaluate the effects of the program: reading achievement; mathematics achievement; teacher ratings of school adjustment; parental involvement; special education placement; and grade retention. Results indicated that the duration of intervention was significantly associated with all outcomes. Analysis of seven intervention and comparison groups differentially exposed to the intervention revealed that children participating in full intervention through third grade or participating in the intervention through second grade were the only children who consistently outperformed the comparison group on the outcome variables, notably for grade retention, reading, and mathematics achievement. Results support the value of extended early childhood intervention programs with at-risk children. (MM)

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Effects of a Preschool Plus Follow-on Intervention Program for Children at Risk

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Running Head: Preschool Plus Follow on

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Abstract

Evaluated a federally funded preschool-to-Grade 3 intervention program for six outcomes through Grade 5. Nine hundred and fifteen (915) low-income black children from the inner city were differentially exposed to school-based, comprehensive-service components for up to five or six years of intervention. One hundred and ninety-one (191) children served as the comparison group which received only a local all-day kindergarten program. Results indicated that the duration of intervention was significantly associated, in the expected direction, with reading achievement, mathematics achievement, teacher ratings of school adjustment, parental involvement in school activities, grade retention, and special education placement. Analysis of seven intervention and comparison groups differentially exposed to the intervention revealed that children participating in full intervention through Grade 3 or participating in the intervention through Grade 2 were the only children who consistently outperformed the comparison group on the outcome variables through Grade 5, notably for reading achievement, mathematics achievement, and grade retention. Children with up to three years of intervention experience were no better adjusted than the comparison group at the end of the program and in Grade 5. Effect sizes at the 2-year follow-up for full participation in the intervention through Grade 3 were .47, .50, and -.51 standard deviations, respectively, for reading achievement, math achievement, and grade retention. Effects on teacher ratings of school adjustment, parental school involvement, and special education placement were smaller but in the expected direction. Adjustment differences by program site varied as a function of parental involvement and poverty. Results support the value of extended early childhood intervention programs with children at risk.

The purpose of this study was to evaluate the effects of a government-funded preschool and primary-grade intervention program for economically disadvantaged children at risk of school failure. The central question was: Does continuous participation in the intervention through Grades 2 and 3 promote children's school adjustment and success more than that of preschool and kindergarten intervention? The answer to this question is urgently needed for two reasons. First, the number of children at risk due to poverty and associated factors is increasing. Over four million more children are expected to live in poverty in 2020 than in 1987, leaving 26% of all children in poverty (Natriello, McDill, & Pallas, 1990). Also increasing is the number of children with mental health and academic problems, which now afflict nearly one-third of all children (Tuma, 1989). Unless effective early intervention programs are identified and implemented, the incidence of school maladjustment, underachievement, school failure, and delinquency will increase dramatically in the future. Second, the effects of preschool intervention plus follow-on intervention into the primary grades are largely unknown. In a time of limited financial resources and significant need, the appropriate timing and duration of such programs are critical issues that must be addressed to identify the best available means of improving at-risk children's school adjustment.

Research Context

Early childhood interventions are designed to provide cognitive and social stimulation during a sensitive period of development. Often targeted at the family and school contexts, a goal is to instill adaptive behavior in children to successfully negotiate the transition to school and other social contexts (Schweinhart & Weikart, 1988; Wachs & Gruen, 1982). Preschool intervention programs for economically disadvantaged children have the additional goal of preventing poor adjustment outcomes such as school failure that are associated with poverty and its stressful consequences. Over time, many preschool intervention programs have demonstrated beneficial effects. Studies of intensive experimental programs (Berrueta-Clement, Schweinhart, Barnett, Epstein, & Weikart, 1984; Lazar, Darlington, Murray, & Snipper, 1982), Head Start (McKey, Condelli, Ganson, Barrett, McConkey, & Plantz, 1985; Hubbell, 1983), and many other programs (White, 1985) have shown that one or two years of preschool can improve children's

school readiness, early academic achievement, and school competence such as lower grade retention and special education placement. Also, there is some evidence that preschool participation even contributes to longer-term outcomes such as reduced school dropout and delinquency behavior in adolescence (Berrueta-Clement et al., 1984). Several program attributes are associated with the quality of intervention, including the provision of comprehensive services (e.g., health, social, and cognitive-academic), parent involvement, low child-staff ratios, and a child-centered focus (Chafel, 1992; Schorr, 1988; Schweinhart & Weikart, 1988; Zigler & Valentine, 1979). Direct parent participation in the program is the most distinguishing aspect of contemporary intervention programs since interventions historically have not actively involved parents (Zigler & Finn-Stevenson, 1992). Parent involvement appears to strengthen the bond between family and school which positively affects child adjustment (Comer, 1988).

The effect of early childhood intervention on school readiness at kindergarten entry (i.e., intellectual or cognitive development) is by far the largest and most consistent finding to date -- on average, one-half a standard deviation (McKey et al., 1985; White, 1985). During the transition to formal schooling in kindergarten and Grade 1, however, observed effects of intervention, at least on scholastic achievement, begin to dissipate so that by Grade 3 there are often no observable differences between intervention participants and nonparticipants (McKey et al., 1985; White, 1985; Woodhead, 1988). While the lack of long-term effects on scholastic achievement was initially interpreted to mean that preschool is ineffective, it is now widely acknowledged that it is unrealistic to expect preschool or any short-term intervention by itself to permanently alter children's cognitive and social development, especially without taking into account the environments children enter after preschool. As Zigler and Berman (1983) indicated, a one year intervention cannot "inoculate a child against continuing disadvantage" (p. 898).

In response to the findings of fading effects of preschool interventions as well as the desire to improve children's success in school, research investigators, notably two advisory panels for Head Start (National Head Start Association, 1990; U. S. Department of Health and Human Services, 1980; Zigler, in press) recommended that to be most effective, early interventions should last longer. Presumably, such program may enhance the continuity of development between

preschool and formal schooling by providing structured support services (i.e., school, family, health-related activities). Research has demonstrated that the transition to full-time schooling is a critical process in children's lives (Alexander & Entwisle, 1988; Entwisle, Alexander, Cadigan, & Pallas, 1987; Entwisle & Hayduk, 1982) and may benefit from efforts to improve continuity between stages. As Brim and Phillips (1988) indicated "more intensive interventions of longer duration seem necessary to produce changes beyond sensitive growth periods". However, there is little empirical support for the efficacy of such extended intervention programs. Although Project Follow Through was originally designed for this purpose, substantial reductions in funding and changes in objectives (testing instructional models rather than providing transitional services for Head Start participants) have precluded it from being a successful follow-up program (Zigler, in press).

In one of the few studies of its effects on individual children, Abelson, Zigler, and DeBlasi (1974) found that 35 children who participated in Follow Through from kindergarten to third grade after enrolling in Head Start preschool scored significantly higher in cognitive performance than 26 children who did not attend preschool or Follow Through (measured by the Peabody Picture Vocabulary Test, the Picture Arrangement Test, and two of five subtests of the Peabody individual Achievement Test). The four-year program did not, however, raise children's performance to the level of nondisadvantaged children's. Nevertheless, Abelson et al., (1974) concluded that "a one year Head Start experience, if not followed by a subsequent compensatory effort, has little lasting effect on children's performance" (p. 766). In a follow-up study with this sample, Seitz, Apfel, Rosenbaum, and Zigler (1983) found that effects on standardized achievement faded substantially by ninth grade except in mathematics and general information for girls. Conrad and Eash (1983) also found positive effects of a federally-funded Child Parent Center intervention program through Grade 3. In this program, children beginning at age 3 enrolled in one or two years of a Head Start-type preschool followed by kindergarten, and then a follow-on intervention through third grade. Third-grade results involving 54 intervention children and 240 non-intervention children found that children with follow-up services did better on cognitive achievement in reading and mathematics achievement as well as locus of control after

taking into account child background factors. Evidence on the stability of effects were not tested. The stability of effects over time, however, were not tested.

Nongovernment-funded model programs with follow-on components also have been evaluated. Horacek, Ramey, Campbell, Hoffmann, & Fletcher (1987) evaluated the Carolina Abecedarian Project, a university-based preschool and school-age intervention program enrolling 54 and 53 children randomly assigned to experimental and control groups, respectively, and differentially exposed to four conditions: (a) preschool plus a school-age intervention through second grade, (b) preschool only, (c) school-age intervention only, and (d) no intervention. The language-based preschool intervention component was by far the most intensive and comprehensive. Children enrolled from three months of age to kindergarten entry and the program ran from 6 to 8 hours per day for 50 weeks a year. The school-age component spanned from kindergarten to second grade and included a home/school resource teacher who provided home activities for parents and their children, made home visits, and consulted with classroom teachers. Results indicated significant associations between the extent of intervention and reading achievement, math achievement, and grade retention by the end of second grade. As expected, children participating in preschool and the school-age intervention had the lowest incidence of retention and the highest level of academic achievement. The preschool intervention had the greatest effects on children's school adjustment over and above the school-age intervention. The school-age intervention, however, had no independent effect on grade retention or achievement above and beyond preschool.

Although these studies are suggestive of positive effects of interventions beyond preschool, much further investigation is warranted before firm conclusions can be drawn about their efficacy. Neither Abelson et al. (1974) or Horacek et al. (1987), for example, found significant effects of the follow-up intervention controlling for the effects of preschool and child background factors. One reason may have been the small sample sizes employed which substantially reduced the statistical power to detect differences between groups. Not only would studies of larger samples provide more statistically powerful tests, but they would also yield more stable and robust estimates of effects.

The appropriate timing and duration of intervention programs also is unclear from previous studies. Although it is clear that three or four years of intervention yielded stronger and more lasting effects than one year of preschool, more uncertain is the number of years that are necessary to yield long-lasting effects. Will two or three years of good quality intervention produce the same effects as four years? -- or should programs run beyond four years? Of equal importance is the timing of such interventions. Does it matter if the intervention begins at preschool or kindergarten as long as children get continuous intervention beyond a year or two? Abelson et al's. (1974) and Conrad and Eash's (1983) findings suggest that preschool is not as important as receiving a continuous intervention from preschool to at least Grade 2. Although the effects of extended programs would be expected to vary by the quality of program, additional research is needed.

In contrast to Abelson et al. (1974) and Conrad & Eash (1983), Horacek et al., (1987) found no independent effect of the school-age component after taking into account preschool participation. Studies testing a wide range of different combinations of intervention exposure would be informative and would illuminate this issue. Conrad and Eash's (1983) finding that preschool did not contribute to third grade outcomes independent of the grade-school intervention suggests that as long as children receive follow-up services, preschool enrollment has relatively limited impact. Separate analysis of no preschool-follow-on and preschool-follow-on groups is required, however, to directly answer this question. Also warranted are investigations of the effects of extended preschool interventions over time.

Besides additional studies with larger samples and varied intervention exposure, studies of government-funded programs in public schools are warranted. Unfortunately, most of the evidence of mid- to long-term effects of early interventions come from experimental or model programs that are implemented under ideal conditions -- they are small-scale programs usually tested at one or two sites, they are based in settings (usually universities) with extensive financial and human resources, and they have very low child to staff ratios (i.e., 5 to 1). These conditions are at variance with more typical large-scale and financially restricted programs conducted in low-income communities and sponsored by federal and state governments. Consequently,

generalization of findings of long-term effects to Head Start-type programs is unclear (Woodhead, 1988) and may require a leap of faith. Although experimental programs indicate the effects of interventions that are possible, policy makers want to know the actual effects of government-funded programs and what exactly taxpayers are getting for their money. As Haskins (1989) indicated, "it is surprising that after 20 years, we still do not have good long-term studies of Head Start. The American public spends more than $1 billion per year on Head Start, and yet we have little credible evidence of the positive outcomes that we know.....are possible" (p. 280). This is not to suggest that model programs cannot inform program and policy development. They have and they will continue to. However, more direct evidence is needed, especially on long-term effectiveness.

Finally, future studies of the effects of interventions would benefit from the use of a wider range of outcomes. Many studies of the effects of intervention programs use cognitive functioning or scholastic achievement as the primary outcome. Given the inherently multiple objectives of intervention programs, a focus on one or two outcomes restricts a comprehensive understanding of program effectiveness. Recent shifts toward the use of such measures as grade retention and special education placement have been important in broadening conceptions of program outcomes. Zigler and Trickett (1978) recommended social competence as the most appropriate outcome of interventions. Concerned with a range of cognitive, social, and health-related outcomes, social competence as the primary outcome of interventions has been advocated by the Head Start Commission (National Head Start Association, 1990). It also includes parent involvement since Head Start and similarly designed intervention programs often require parent involvement in school activities. Not only is increased parent involvement a goal of such programs but it also has been hypothesized to be a mechanism by which interventions transmit long-term effects (Bronfenbrenner, 1975; Seitz, 1990; Wachs & Gruen, 1982). Reynolds (1992a) provided empirical support for this proposition. Further studies of the effects of interventions on parent involvement could provide valuable information by which to improve children's school success.

The present study evaluates the effects a federally-funded Child Parent Center Intervention Program, a comprehensive preschool-to-Grade 3 intervention for economically and educationally disadvantaged children in the Chicago Public Schools. The program is distinctive in its integration of preschool, kindergarten, and primary-grade (or follow-on) components into a single school-based program. Also, children were differentially exposed to preschool, kindergarten, and follow-on components, thus allowing for detailed assessments of up to five or six years of intervention. Finally, the large sample and longitudinal data allow for assessment of the program across multiple outcomes up to two years following the intervention. This study addressed the following questions: (a) Is the duration of program participation associated with better academic and social outcomes? (b) Does participation in the primary-grade component improve children's adjustment above and beyond participation in preschool? (c) What is the stability of intervention effects at the 2-year follow-up assessment?

Methods

Sample

Children in this study are part of the Longitudinal Study of Children at Risk (Reynolds, 1991, 1992b), a comprehensive investigation in which the effects of the Elementary and Secondary Education Act (ESEA) Chapter I funded Child Parent Center (CPC) Program is one major question. Funds for Chapter I are dispersed by the U. S. Department of Education to school districts with large proportions of educationally needy low-income children. The original sample of 1,539 low-income, minority children (95% black, 5% Hispanic) in 26 schools was selected as a representative sample of children participating in Chicago's government-funded kindergarten programs in 1986. The sample included 1150 children in 20 CPCs and a minimum-intervention comparison group of 389 children in 6 randomly selected schools participating in a locally funded kindergarten program for low-income children. Children entered the programs in either preschool or kindergarten. For both the CPC and local kindergarten program, enrollment requires residency in school neighborhoods eligible for Chapter I services, and applicants were accepted on a most-in-need basis. All families that were eligible voluntarily enrolled their

children in a preschool or kindergarten program, although in many cases they were recruited by schools and social service agencies.

The sample, by definition, fairly well represents a large proportion of children at risk due to poverty in Chicago and probably other large metropolitan school districts. Moreover, children were at multiple risk of school difficulties. Besides living in poverty neighborhoods, children were minority and experienced economic need (i.e., over 90% of parents reported their child was eligible for a full or reduced lunch subsidy). The school poverty rate for children in the study sample was 66%, compared to 42% for the total school system.

Attrition. By the end of their fifth grade year in the spring of 1991 (Grade 5 for continuously promoted children), 1,245 (81%) children remained active in the school system. This group was similar to the original kindergarten sample on several background characteristics, including gender, race, age at school entry, school socioeconomic status, and kindergarten achievement.[1] This total sample retention rate is substantially higher than the typical rate of 50% for longitudinal studies (Kessler & Greenberg, 1981). Also, sample retention (nonattrition) was similar among children entering the CPCs in preschool (83%) or kindergarten (74%), and entering the local kindergarten program (79%).

The study sample included 1106 black children. Because they constituted only 5% of the sample, 60 Hispanic children were excluded from the study sample. Also excluded were 79 children who participated in Head Start or Follow Through Programs. These exclusions had no effect on the findings of the study, and allow for a well-defined study sample of children most affected by the program.[2] Consequently, this is a study of inner city, black children exposed to the CPC intervention program for different lengths of time.

The Child Parent Center Intervention Program

In 1967 the federal government provided Title I (now Chapter I) funds for the establishment of several Child Parent Centers in the Chicago Public Schools for economically and educationally disadvantaged children. The program is currently implemented in 25 Centers throughout the city. This study reports on the 20 centers (plus six comparison schools) that have both preschool and kindergarten components. In 1978, a CPC expansion program was added to

the CPCs in order to provide program services into the primary grades. Funded by the State of Illinois, 14 centers provide services up to Grade 2 and 6 centers provide services up to Grade 3. Consequently, the total program includes preschool, kindergarten, and primary-grade services up to Grade 3. The centers are neighborhood schools in which all children receive the intervention program. The preschool and kindergartens are in separate buildings or wings of the main buildings. In the primary grades, the program occupies the main school building.

Like Head Start and other multi-faceted interventions for children at risk, the program provides comprehensive health, social, academic, and school support services in order to promote reading readiness and affective development for school entry and beyond. Also, there is no uniform curriculum. Each center tailors its program to children's needs. Unlike Head Start, the CPC program provides services from preschool to Grade 3 for up to 6 years of intervention. The preschool component is a structured half-day program for three- and four-year olds and is designed to promote children's school readiness and reading/language skills. The kindergarten component provides all day services (at most sites) to promote reading readiness and affective development. The primary-grade or follow-on component is a logical extension of the first two components and emphasizes reading and writing activities, drill and feedback, and individual attention (Stallings, 1975). All of the components run five days per week for the 9-month school year. Children enrolled for the following number of years: 0 = 191 (comparison group), 1 = 25, 2 = 135, 3 = 169, 4 = 253, 5 = 254, 6 = 79.

The CPCs emphasize a core philosophy which includes the provision of comprehensive services, parent involvement, and child-centered activities. All have been strongly associated with program quality (Chafel, 1992; Schweinhart & Weikart, 1988; Zigler & Valentine, 1979).

Comprehensive services. The comprehensive services include (a) attending to children's nutritional and health needs (i.e., free breakfasts and lunches, and health screening), (b) coordinated adult supervision including a CPC head teacher, parent resource teacher, school-community representative as well as a teacher aide for each class, (c) funds for inservice teacher training in child development as well as instructional supplies, and (d) emphasis on reading readiness, frequent reading activities, reinforcement, and feedback. The parent resource teacher

organizes the parent-resource room, which is designed to initiate education activities for parents as well as to foster parent-child interactions. The school-community representative monitors parental as well as child school involvement and, if necessary, visits families in their home.

Average class sizes for the preschool component were 17 with an adult-to-child ratio of 1 to 7). For the kindergarten and primary-grade components average class sizes are 25 with adult-to-child ratio of 1 to 11. The per-pupil annual cost of the preschool and kindergarten program is $3,000 each (1990 dollars; Chicago Public Schools, 1990). The per-pupil annual cost of the primary-grade component is $3,500. These costs include both non-capital and capital expenditures such as instruction, teacher salaries, school supplies, building maintenance, food service, and transportation.

Parent involvement. As implied in the program's title, a central philosophy of the program is that parent involvement is the critical socializing force in children's development. Because of the stresses associated with poverty and economic hardship, low-income families are often disconnected from schools and other community support systems that are important for healthy development (McLoyd, 1990). Direct parent involvement in the CPCs is expected to enhance parent-child interactions as well as attachment to school, thus promoting school readiness and social adjustment (Baumrind, 1971; Bronfenbrenner, 1975). At least one-half day per week of parent involvement in the center is required. Parent involvement includes volunteering as classroom aides to tutor children, performing clerical tasks, accompanying classes on field trips, interacting with other parents in the center's parent resource room, participating in reading groups with other parents, attending school meetings and programs, participating in educational workshops, doing craft projects for use in the school or at home, and taking trips to the library with teachers and/or their children. Schools also frequently sponsored night courses for parents to obtain additional education, including their high school certificates. Besides class sizes, the major difference among program components was that parent involvement was encouraged rather than required in the primary grades, and both parent involvement and curriculum coordination were conducted by a single teacher.

Child-centered focus and reading readiness. The smaller class sizes and greater number of adult supervisors allow more individualized and child-centered attention in order to develop reading comprehension and writing skills (Stallings, 1975). This focus is based on the philosophy that failure to learn to read is a major cause of school maladjustment of children at risk (Chall, Jacobs, & Baldwin, 1990; Slavin, Madden, Karweit, Livermon, & Dolan, 1990). Through a broad spectrum of activities such as small group and workbook activities, children learn to read and write. In this process, teachers provide frequent feedback and positive reinforcement as well as emphasize task accomplishment, all of which are associated with successful school performance and adjustment (Stallings, 1975). Also, teachers frequently read stories to the class to develop the idea that reading is fun and to demonstrate "book language." Reading and writing activities in the program, for example, occupy 50% and 23% of classtime, respectively. Moreover, classes go on field trips to, for example, the Museum of Science and Industry and the zoo. Monthly inservice teacher training sessions conducted by the Bureau of Early Childhood reinforce the emphasis on child-centered activities.

Implementation

The CPC program has been consistently implemented with success based on classroom observations, interviews, and school records (Chicago Public Schools, 1986, 1987a, 1987b). For example, the average child attendance rate across centers in preschool (1984-85) was 94%, and 93% in kindergarten and the primary grades (1986-88). Detailed observation of the kindergarten component found that all centers successfully provided comprehensive services, parent involvement activities, and child-centered services (Chicago Public Schools, 1987a). Only the amount of parent involvement in school, however, varied substantially by site. School-level parent involvement ranged from 2.2 to 3.9 across sites, based on a 5-point teacher rating scale measured in Grade 1 (1 = poor/not at all, 5 = excellent/much). Nevertheless, overall parent involvement in the CPCs remained consistently higher than in nonCPC sites (Chicago Public Schools, 1986, 1987a). The amount of parent involvement also was similar between centers implementing the program through Grade 3 and centers implementing the program through Grade 2 (Ms = 3.0).

The primary modes of involvement were participation in school activities and in parent-resource rooms.

By extension, the preschool and primary-grade components, which are implemented in the same sites and have many of the same personnel as the kindergarten component, also were implemented successfully. Previous evaluations have reported successful implementation of the program from preschool to Grade 3 (Stenner & Mueller, 1973; Conrad and Eash, 1983). Conrad and Eash, for example, found the CPCs were rated higher than regular school programs in child-centeredness (e.g., work independently in small groups), evaluation of child activities, and parent involvement in school activities. These findings are consistent with the program's 25 years of implementation since 1967 (15 years for the primary-grade component). Consequently, the program is included in the U. S. Department of Education's National Diffusion Network, a compository of high quality educational programs.

Teacher questionnaire reports indicated that teachers had an average of 12.5 years of experience, and about five years in their primary area (preschool, kindergarten, primary grades). Approximately 50% had bachelor's degrees and 50% had master's degrees (Chicago Public Schools, 1987a). Of the kindergarten teachers surveyed, 86% had kindergarten/primary grade certificates. These experiences were similar across centers and schools.

Intervention Groups

Six intervention groups (plus the comparison group) were formed to directly assess the effects of the CPC program (preschool to Grade 3).[3] To receive services children must have been present in the CPCs. For several reasons, all children did not stay in the sites through Grade 3. For example, many children transferred to regular schools after kindergarten. Others attended centers that had services only to Grade 2. Also, parents enrolled their children at ages 3, 4, or 5. Groups are listed in order of their extent of follow-on intervention during the primary grades (PG; 1 to 3 years) as well as the preschool (PS) and kindergarten (KG) components.

With Follow-on Intervention

A. Full Intervention Group (PS + KG + PG-3) included children who received all components of the program. They had at least one year of CPC preschool, all-day kindergarten, and 3 years of the primary-grade intervention (n = 160).

B. Kindergarten and Primary-grade Intervention Group through Grade 3 (No PS + KG + PG-3) included children with no CPC preschool experience but who participated in all-day kindergarten with some support services from the CPC, and all three years of the primary-grade component (n = 76).

C. Preschool, Kindergarten, and Grade 2 Intervention Group (PS + KG + PG-2) included children who participated in at least one year of preschool, kindergarten but two years of the primary-grade component (n = 302).

D. Kindergarten and Primary-grade Intervention Group through Grade 2 (No PS + KG + PG-1/2) included children with no CPC preschool experience but who participated in all day kindergarten with some support services from the CPC, and one or two years of the primary-grade component (n = 36).

E. Preschool, Kindergarten, and Grade 1 Intervention Group (PS + KG + PG-1) included children who participated in at least one year of preschool, kindergarten, and only one year of the primary-grade component (n = 80).

Without Follow-on Intervention

F. Preschool and Kindergarten Intervention Group (PS + KG) participated in both CPC preschool and kindergarten but not the primary-grade component (n = 207).

G. The NonCPC comparison group did not participate in preschool, kindergarten, or primary-grade intervention programs but did enroll in the locally developed all-day kindergarten program for children in low-achieving schools (n = 191). Like CPC children, comparison-group children were eligible for Chapter I services and had educational need due to economic disadvantage. Because of their participation in the alternative kindergarten program (i.e., minimum-treatment comparison group), the analysis may be a conservative test of the effects of

the CPC program. This test, however, is more ecologically valid since most children enroll in kindergarten.

Unlike CPC children, comparison-group children received no continuous and systematic intervention from preschool through Grade 3. Average class sizes were 30 in kindergarten and 30 in the primary grades. Comprehensive school support services, additional staff (i.e., head teacher, parent resource teacher), and extra instructional supplies were not provided. Besides basic funding for the kindergarten program, teacher assistants and inservice teacher training in child development was provided. Instruction was whole class rather than small group and individualized. and extra instructional supplies were not provided.

Group Comparability

Although random assignment to intervention and comparison groups was not possible, a number of design features make comparisons among groups valid. All children were eligible for intervention services due to economic and educational disadvantage. All parents voluntarily enrolled their children in a preschool or kindergarten program. Consequently, the natural variation in exposure to intervention provided several contrasts among groups with similar educational needs and degrees of self-selection. For example, self-selection is unlikely to be a significant factor in adjustment differences between the PS + KG and PS + KG + PG-3 groups because both enrolled in preschool. Moreover, data were collected on several child and family variables that may impact parents' decision to enroll their child in the intervention, thus reducing the influence of self-selection. Table 1 shows that the intervention groups were comparable on several sociodemographic factors including sex, parent education, eligibility for free lunch, parent expectations, age at kindergarten entry, and number of siblings. Differences occurred on school SES in kindergarten (poverty rate), as the full-intervention group attended kindergarten schools with a higher proportion of non-low-income families. However, this difference was mitigated by the finding that kindergarten SES was unrelated to program outcomes at the end of the program in Grade 3. Analysis of additional factors that may account for group differences also were investigated through latent-variable structural modeling.[4] Notwithstanding these similarities, the sociodemographic variables were used as control variables in the analyses. The

inclusion of parent education (high school graduate or not), socioeconomic status (eligibility for lunch subsidy), and parent expectations ("How far in school will child get?"), which were collected after the end of the intervention, may result in conservative estimates of intervention effects. Because the CPC program is designed, in part, to enhance parent skills and attitudes toward education, these three factors have almost certainly been impacted by the intervention. Consequently, their inclusion in the analysis would tend to reduce estimates of effects.

Insert Table 1 about here

Outcome Measures

Six outcomes, measured in Grades 3 through 5, were used to evaluate the effects of the CPC intervention program. With the exception of parental involvement, they have been frequently used in previous studies.

Reading achievement and mathematics achievement. Reading comprehension and mathematics total subtest scores on the Iowa Tests of Basic Skills (ITBS; Hieronymus, Lindquist, & Hoover, 1980) were used as measures of cognitive achievement. Both nationally standardized subtest scores have demonstrated high reliability (KR-20s > .90) and predictive validity (Hieronymus & Hoover, 1990). The reading comprehension subtest included 47, 49, and 54 items, respectively, in Grades 3 through 5; the mathematics total subtest had, respectively, 88, 95, 101 items. Norm-referenced in 1988, the ITBS is group-administered each year in April. Developmental standard scores are used for all analyses. The Grade 3 scores are based on the 1978 norm-referenced test (Form 7 Level 9) but were converted to 1988 scores.

Tests were administered under standardized procedures by school personnel other than the classroom teacher. Staff from the central offices of the school district as well as school counselors and other teachers conducted testing under the supervision of a school testing coordinator. Consequently, test administration was independent of the intervention experiences received.

Teacher ratings of school adjustment. Teachers rated children's school adjustment on a six-item composite rating scale with each item rated from poor/not at all (1) to excellent/much (5).

1. Concentrates on work. 2. Follows directions. 3. Is self-confident. 4. Participates in group discussions. 5. Gets along well with others. 6. Takes responsibility for actions.

Based on principal components analysis, this reliable scale (alpha = .94) has been used successfully in previous studies with this sample (Reynolds, 1989, 1991) and correlates .85 with the total teacher rating scale from which it was derived. Moreover, the scale's moderate correlations with Grade 4 reading and mathematics achievement (rs = .48 and .54, respectively) suggest adequate construct distinction. Although teacher ratings may have some degree of bias and subjectivity, they are essential in providing a well-rounded view of children's school adjustment.

Parental Involvement in school. Teachers rated parents behavioral involvement in school from the item "Parents involvement in school activities." It was rated on a scale from 1, poor/not at all to 5, excellent/much. Although teacher reports have a subjective component, the focus on general school relations is clearly an area about which teachers have knowledge (Reynolds, 1991; Stevenson & Baker, 1987). The use of teacher report was supported by principal components analysis, which suggested its relative independence from measures of school progress. Also, previous research with this sample has indicated a moderate and significant relationship between parent and teacher reports of parent involvement in school (Reynolds, 1992c). Nevertheless, because of the use of a single item the effects of intervention on parental involvement are likely to be conservative.

Special Education Placement. Any child assigned to special education classrooms (self-contained or otherwise) through Grade 3, Grade 4, and Grade 5 were coded 1; all others were coded 0. This defined a cumulative classification of placement. Major categories of assignment included mildly mentally retarded, behavioral disorder, and learning disabled.

Grade Retention. Children on record as repeating a grade at least once between kindergarten and Grade 5 were coded 1 (retained); all other children were coded 0 (promoted or not retained). Data on retention was obtained from a grade-by-grade analysis of the school system's computerized records. A child was coded as retained if he/she had identical grade codes

in consecutive school years. The few missing grade codes (< 15) were filled with an estimate based on a combination of the test level and adjustment scores prior to grade retention.

Control Variables

Sociodemographic factors include many commonly used correlates of academic achievement and school adjustment including sex (1 = girls, 0 = boys), age at school entry, parent education (high school graduate or not), an ordinal indicator of family income -- children's eligibility for a federal lunch subsidy, and parent expectations of child's schooling ("How far in school with your child get?"; 4 = beyond the baccalaureate, 1 = graduate from high school). The latter three variables were obtained from parent questionnaires in Grades 2 and 4. Although these socioeconomic variables were measured after children's school entry, they were expected to be fairly stable indicators, especially given the sample's at-risk status. Moreover, school SES in kindergarten (% of families in school region who are low-income) was included as a measure of the socioeconomic context of the kindergarten school where most, if not all children grew up (Chicago Public Schools, 1987b). Finally, the number of siblings were used as an indicator of family size. It was taken from child survey responses in Grade 3.

Some children were missing data for the control variables. Valid Ns for kindergarten age, number of siblings, parent education, eligibility for lunch subsidy, and parent expectations were, respectively, 1,040, 895, 758, 758, and 751. Because the major analyses were based on analysis covariance via multiple regression with pairwise-present cases children with valid values for any combination of variables were included. The effect of missing data was investigated for variables with the most missing cases -- parent education, lunch subsidy, and parent expectations (23% to 33% missing).[5] Missing data on these variables did not differ among the intervention groups.

Results

Findings are reported in three sections: (a) preliminary analysis of children with and without intervention experience and by duration of experience, (b) primary analysis of mean differences among the intervention and comparison groups, and (c) supplemental analyses of the effects of intervention by school mobility and across sites.

Preliminary Analysis of Participation in Intervention

Before determining the association between the duration of intervention and child outcomes, a summary analysis of intervention and comparison groups was conducted. Table 2 presents adjustment differences between children with any CPC experience and nonCPC participants at the end of the program (Grade 3). Results are based on analysis of covariance via multiple regression with CPC intervention status binary coded. The control variables were sex, parent education, eligibility for a lunch subsidy, parent expectations, school SES in kindergarten, age at kindergarten entry, and number of siblings.[6] As expected children with any CPC intervention experience significantly outperformed the nonCPC comparison group on 4 of 6 outcomes at the end of the program. These included reading achievement, mathematics achievement, parent involvement, and incidence of grade retention. Group differences were negligible for teacher ratings of school adjustment and incidence of special education placement. In Grade 4 significant group differences remained for reading achievement, mathematics achievement, and incidence of grade retention. In Grade 5, only for mathematics achievement did CPC participants significantly outperform comparison-group participants. These findings support the positive influence of participation in early childhood intervention found in many previous studies. Adjustment differences by duration of intervention, however, remain at issue.

Insert Table 2 about here

To examine the relationship between duration of intervention (0 to 6 years) and program outcomes correlations were computed using Joreskog and Sorbom's (1988) method for ordinal variables.[7] Number of years of intervention was significantly associated, in the expected direction, with all 6 outcomes. At Grade 3, correlations were as follows: for grade retention (r = -.27), reading achievement (r = .26), and mathematics achievement (r = .25), parent involvement in school (r = .24), teacher ratings (r = .14), and special education placement (r = -.08). By Grade 5, correlations between intervention exposure and the outcomes were generally smaller but they remained statistically significant. Also, cognitive-academic outcomes (grade retention, reading

achievement, and mathematics achievement) were more associated with the number of years of intervention than the social outcomes (teacher ratings, parent involvement in school, and special education placement).

As illustrated in Figure 1, however, the associations were not completely linear; rather, a threshold occurred at four or five years of intervention. Children who participated in the program for at least four years scored substantially higher in reading and mathematics achievement, were rated higher by teachers on social adjustment and parental school involvement, and were retained much less frequently than children with zero to three years of intervention experience. These threshold patterns may partly explain the modest correlations between intervention exposure and program outcomes. This pattern of findings remained after controlling for the influence of the sociodemographic factors in Table 1. Further note that the means for children with one year of intervention should be interpreted with caution since they are based on only 25 children, most of whom are boys.

Insert Figure 1 about here

Four through six-year participants scored above the Chicago average in reading and mathematics achievement; five and six-year participants were retained at or below the national retention rate at third grade (Meisels, & Liew, 1991). Six-year participants performed best across all outcomes. They scored at or near the national mean in reading and mathematics achievement, and had a grade-retention rate of 5%.

Primary Analysis: Mean Comparisons of Intervention Groups

Tables 3 and 4 present unadjusted and adjusted means for 5 intervention groups and the minimum-treatment nonCPC comparison group over the three-year period of study. For parsimony, means for the No PS + KG + PG-1/2 group are not shown. Their adjustment was consistently similar to the comparison group and the PS + KG group for all outcomes in Grades 3 through 5.[8] Adjusted means were based analysis of covariance via multiple regression (Cohen & Cohen, 1983) with the sociodemographic factors as control variables and using pairwise-present

cases.[9] No differential effects of the intervention by gender, parent education, and for years of preschool enrollment were detected.

As with the preliminary analysis, children participating in all components of the program performed better than children with less intervention experience. This was especially true of children participating in the full intervention through Grade 3. At the end of the program (using adjusted standard scores) they had the highest achievement in reading (M = 102.2, percentile rank = 41%) and mathematics (M = 106.1; percentile rank = 47%), teacher ratings (M = 20.3 out of 30), and parent involvement (M = 3.0 out of 5) as well as the lowest incidence of retention (6.6% ever retained). Six-year participants were even better adjusted (see Figure 1).

Insert Tables 3 and 4 about here

In contrast, the nonCPC comparison group performed, on average, significantly lower on five of six outcomes at the end of the program: reading (M = 90.8, percentile rank = 19%), math (M = 96.6, percentile rank = 19%), teacher ratings (M = 18.7 out of 30), parent involvement (M = 2.3 out of 5), and grade retention (26% ever retained). This retention rate is over four times greater than the full intervention group.

The adjustment of children who participating in the intervention during preschool and kindergarten only (PS + KG) or up to one year of the primary-grade component (PS + KG + PG-1), however, did not significantly differ from the no-intervention comparison group at the end of the program or at the 2-year follow-up in Grade 5 for any outcome. Note that the unadjusted means and adjusted means were very similar. This pattern suggests initial comparability of the intervention groups. Results are reported by outcome.

Reading achievement. At Grade 3, children who enrolled in three years of PG were, on average, superior to other children regardless of whether or not they participated in preschool. In Grade 5, however, only children who participated in all components of the program through second or third grade were significantly higher in reading achievement than the nonCPC comparison group. As shown in Table 3, these children had a adjusted mean scores of 116.8 and

114.7, respectively, 5 to 7 points higher than the comparison group and the PS + KG group. The pattern of results also indicates that the comparison begins to catch up with the intervention groups rather than the intervention groups falling back. The equivalent performance of the PS + KG and comparison groups over time indicate the limits of preschool intervention by itself to extract longer-term gains.

Of additional interest was the superior performance of the no preschool KG + PG-3 group at the end of the program. Only the full intervention group (PS + KG + PG-3) had better scores. But by Grade 5 their group performance lagged that of the full intervention group and the PS + KG + PG-2 group, probably because they lacked preschool experience. However, all groups were, on average, far below the national mean in Grade 5. For example, the average score of the non-retained full-intervention group was at the 28th percentile, one year below the national mean for fifth graders.

Mathematics achievement. As with reading achievement, the full intervention group with two and three years of follow-up services scored consistently higher than the comparison group from Grades 3 to 5. Although the No PS + KG + PG-3 group outscored the PS + KG + PG-2 group at the end of the program, by Grade 5 they did not differ significantly with the comparison group. These results indicate that while intervention in kindergarten and primary grades has an immediate effect, this effect does not last without prior preschool experience. As with reading, mean math scores were considerably below the national mean for fifth graders. The non-retained full-intervention group scored in the 29th percentile.

Teacher ratings. Only the full intervention group had significantly higher ratings than the comparison group at the end of the program in Grade 3, approximately two points on a scale from 6 to 30. This effect was also detected in Grade 4 but disappeared in Grade 5. The PS + KG + PG-2 group, though rated 1 to 1 1/2 points higher than the comparison group (especially at Grade 4), these differences were not statistically significant. All other intervention groups were rated similar to the nonCPC comparison group in Grades 3 to 5. These findings, though not as strong as for achievement, lend support to the value of the intervention on non-achievement outcomes.

Parental involvement. Parent involvement for children in the full intervention group was significantly higher than the other groups. By Grade 5, however, groups were not significantly different. Whereas the PS + KG + PG-3 group had higher ratings than the comparison group at the end of the program (adjusted Ms = 3.0, 2.3), in Grade 5 parent involvement ratings were similar between groups (adjusted Ms = 2.5, 2.5). The decline in parent involvement over time may reflect the shift from family-child relations to peer relations as children begin to enter adolescence. As with the achievement and teacher ratings, the PS + KG group had no better ratings on parent involvement than the comparison group. This finding further illustrates the limits of one or two years of intervention. Interestingly, the comparison group means increased over time while those of the intervention groups declined.

Grade retention. One of the largest effects of the intervention program was on the cumulative rate of grade retention. At the end of the program in Grade 3, PS + KG + PG-3 and PS + KG + PG-2 groups had adjusted retention rates of 6.6% and 16.9%, well below the 26% for the comparison group. The rate of retention for the no preschool KG + PG-3 group also was substantially lower (12.3%) than the comparison group and all other intervention groups with the exception of the full intervention group.

By the end of Grade 5 only the full intervention group (15.3%) and the PS + KG + PG-2 (22.8%) had significantly lower rates of retention than the comparison group (31.3%); these rates also were substantially lower than the other intervention groups.

Special education placement. There was no consistent evidence of intervention effects on special education placement. Only the PS + KG + PG-2 group had lower placement rates than the comparison group, and these occurred in Grades 4 and 5. Surprisingly, this intervention group also had significantly lower rates of placement than the other intervention groups, including the full intervention group. Because only one group showed significant differences, results were not interpreted as intervention effects.

Effect sizes of intervention components. So far the analyses reveal that without follow-up intervention, enrollment in preschool and kindergarten programs makes little difference in academic and social adjustment. Figure 2 summarizes the effect sizes (ES) of the preschool and

primary-grade components as well as the full intervention (preschool to Grade 3) at the end of the program and at the 2-year follow-up. The effects of the kindergarten component are not reported because all children received kindergarten services, thus these effects are not meaningful. ESs are proportions of standard deviations and are comparable across outcomes regardless of the metric used. They are calculated by dividing the mean difference (adjusted) between intervention and comparison groups by the pooled standard deviation of each respective outcome (Hedges & Olkin, 1985).[10] Values of .25 and above are generally interpreted as educationally meaningful (Glass, McGaw, & Smith, 1981).[11]

Insert Figure 2 about here

At the end of the program the effects of the full intervention were educationally meaningful for five of six outcomes (no effects for special education placement). In order of magnitude they were as follows: reading achievement (ES = .66), grade retention (ES = -.64), mathematics achievement (ES = .63), parent involvement in school (ES = .61), teacher ratings (ES = .26), and special education placement (ES = -.12). Effects of the full intervention remained moderately educationally meaningful up to two years following the program for reading achievement (ES = .47), mathematics achievement (ES = .50), and grade retention (ES = -.51). Effects on teacher ratings, parent involvement in school, and special education placement were smaller and marginally educationally meaningful. Both preschool and primary-grade components contributed substantially to the full intervention effect, indicating that participation in the full intervention is better than participation in the either the preschool or primary-grade component alone. This pattern illustrates the cumulative effect of intervention exposure.

Supplemental Analyses

Intervention effect versus school-stability effect. Because participation in the full intervention required staying in an intervention school during the primary grades an alternative explanation to the observed differences between intervention and comparison groups is that the absence of school mobility caused such differences. To address this issue, the full-intervention

group (PS + KG + PG-3) was compared with school-stable children (through Grade 3) in the comparison group.

Table 5 presents the results for reading achievement, mathematics achievement, and grade retention with significance tests based on a priori contrasts. Full-intervention participants significantly outperformed school-stable nonCPC participants on all outcomes up to two years following the intervention. For reading, the 9.6 point advantage of the full intervention group at the end of the program was 5.3 points at Grade 5. Similarly, the full intervention group outperformed the comparison group in mathematics, and they had a 38% lower rate of retention (adjusted) than the school-stable comparison group in Grade 5 (15% vs. 24%). Despite the more modest group differences, these results disconfirm the hypothesis that the observed intervention effects are due to school stability. Interaction effects involving school stability by parent education, school stability by eligibility for lunch subsidy, and school stability by parent expectations also did not significantly contribute to adjustment differences between groups.

Insert Table 5 about here

Intervention effects by site. The above findings regard effects of the CPC intervention averaged across all sites (or schools) that implemented the intervention. Because the sites differed, to some degree, in their school characteristics and the extent of parent involvement, analyses of site differences were undertaken. Table 6 presents children's performance at the six sites that implemented the full intervention through Grade 3. Also shown are each school's poverty index (school SES in 1986) and mean parental school involvement. Values for parent involvement are the school-wide averages of teacher ratings of parent participation in school activities in Grade 1 -- the time when the maximum amount of parent data were available. Parent involvement and school poverty had the most variability across sites. Differences in teacher training and experiences, amount of resources, and provision of comprehensive services were similar across sites (Chicago Public Schools, 1986, 1987a).

Insert Table 6 about here

Only at School 6 were adjustment outcomes consistently below that of the nonCPC comparison group and the PS + KG group. Not surprisingly, School 6 had a relatively high rate of poverty (68% of families) and low parental school involvement ($\underline{M}$ = 2.5), the combination of which may have reduced the effectiveness of the program. Schools with higher rates of parental involvement had the best adjusted children (Schools 1, 2 and 3). School poverty rates were unrelated to reading and math achievement but were associated, in the expected direction, with teacher ratings, grade retention, and special education placement ($\underline{r}$s = .54 to .68 in absolute value). School parent involvement was positively and significantly associated with school reading achievement ($\underline{r}$s = .90, .97), although magnitudes should be interpreted cautiously because of the small number of observations. These latter findings suggest that fidelity to parental involvement is a major ingredient in program success.

Analyses of the sites which implemented the intervention through Grade 2 also revealed that a majority of centers performed at or above the overall average for the 14 sites. For Grade 5 reading achievement, 8 of 14 sites performed at or above the overall average. Ten of 14 sites had lower rates of grade retention than the overall average. Smaller relationships were found, however, between school poverty and parent involvement and the adjustment outcomes. School poverty was most associated with special education placement ($\underline{r}$ = .33); school parent involvement was most associated with grade retention ($\underline{r}$ = -.42).

Discussion

This study was designed to evaluate the effects of differential participation in a federally-funded early childhood intervention program on the development of black children from the inner city. The program is based on the provision of comprehensive support services, parent participation, and child-centeredness, all of which have been consistently related to program quality (Chafel, 1992; Schweinhart & Weikart, 1988; Zigler & Valentine, 1979). The CPC program has a history of successful implementation since its inception in 1967. Results indicated

that the duration of exposure to the intervention was significantly related to reading and mathematics achievement, teacher ratings, grade retention, and parental school involvement after controlling for potentially confounding variables. Six years of program involvement were associated with a .66 standard-deviation improvement in reading achievement at the end of the program and .47 standard-deviations at Grade 5 relative to the comparison group. Math achievement scores were similarly affected by the program, and the intervention was further associated with a 52% reduction in grade retention (15% vs. 31%; see Table 4). The effects of the program on parental school involvement and teacher ratings of adjustment were not stable up to Grade 5 but did exist at Grades 3 and 4. Except for children participating in the intervention through Grade 2, incidence of special education placement was unrelated to program intervention. Although both preschool and primary-grade participation contributed to positive adjustment, full participation in the CPC program was required to maintain children's adjustment over time. Children with up to three years of intervention and children with just preschool and kindergarten involvement did no better than children with no prior CPC experience.

A major finding of the study is the relatively superior performance of children who participated in the full intervention program at least through Grades 2 and 3. Not only were they better adjusted than a comparison group of similarly at-risk children but they performed better than children with up to three years of intervention and better than children with kindergarten and primary-grade intervention but no preschool. That participants of preschool and kindergarten components were indistinguishable from comparison-group participants indicates that interventions that do not take account of the transition to the primary grades may not be effective over time. This conclusion is supported by the consistent findings of declining effects on scholastic achievement of early childhood intervention programs over time (Haskins, 1989; White, 1985).

The positive effects of follow-on interventions found in this study are consistent with previous studies of federally-funded intervention programs designed to improve the family-school relationship, including Head Start and Follow Through (Abelson et al., 1974) and Chapter I programs (Conrad & Eash, 1983; Slavin, Madden, Karweit, Livermon, & Dolan, 1990). These

studies support the notion that to be most effective, programs must continue into the primary grades. Longer-lasting intervention services appear to provide the support and continuity necessary to yield more sustained effects. Also, several studies (Alexander & Entwisle, 1988; Entwisle & Hayduk, 1988; Reynolds, 1989, 1991, 1992a) support the value of early intervening school/teacher and family support factors in promoting successful adjustment. Reynolds (1992a), for example, found that parental school involvement and teacher ratings after the end of preschool mediated the effects of preschool intervention on Grade 3 academic outcomes. The present study indicates that comprehensive school-based programs also may provide the necessary support to continue and enhance the effects of the program beyond preschool. Because children at risk in inner cities experience more stressful and persistent negative life events than their more advantaged peers -- economic hardship, unstable home environments, and frequent school transfer -- such support-based programs may be critical to their future success.

The present findings differ somewhat from those of Horacek et al., (1987) since they found that the three-year, school-age component (kindergarten to Grade 2) did not contribute to adjustment outcomes independent of the preschool intervention. This result, however, may have been due to the more intensive and much longer duration of the preschool program (year-round for five years). A similarly intensive follow-up program may have yielded stronger effects. Nevertheless, as in the present study, Horacek et al., (1987) did find a positive linear relationship between the extent of intervention and adjustment outcomes. A unique feature of the present study was the two-year follow-up of children to Grade 5. Evidence for the stability of effects of additional programs may show similar results.

The results indicate no particular advantage of preschool intervention over primary-grade intervention, at least for the child outcomes measured in this study. Children participating in the only the preschool and kindergarten components did no better than children who participated in just the primary-grade component, and neither group performed significantly better than the nonCPC comparison group. What appears to be critical is the provision of a continuous intervention beyond two or three years in which each successive year builds on earlier ones until a threshold of four or five years is reached (see Figure 1). Although by Grade 5 a major portion of

the effects of the full intervention was attributable to the primary-grade component, preschool added notably to the cumulative effect. Of course, evidence for the appropriate timing of interventions is limited in this study to ages three to eight. Evidence of the timing of interventions outside this age range awaits further study.

The strongest and most stable effects of the intervention were on reading achievement, mathematics achievement, and grade retention. These outcomes represent mastery of basic skills, which are predictors of future school and social competence behaviors (Natriello et al., 1990; Stallings, 1975). This result is not surprising, of course, given that reading readiness and family-school relations are primary goals of the program. Which aspects of the intervention contributed to these effects? Although the design of the study does not allow for precise identification of the critical components, parent involvement is one likely ingredient. School parental involvement was directly and positively related to differential performance across sites, especially for cognitive achievement and grade retention. CPCs with higher levels of parental participation in school also had the best adjustment outcomes. Indeed, as with Head Start, the central theory behind the CPC program is enhancing the family-school relationship. Of course, the provision of comprehensive services through low adult-child ratios, staff training, and attending to cognitive, social, and health needs also are characteristic of successful early intervention programs (Chafel, 1992; Schweinhart & Weikart, 1988), and may have contributed to the present findings. Future studies of programs which vary in the provision of services and staff resources will be important in identifying each factor's specific influence.

The study also found intervention effects on parent involvement in school and teacher ratings of social adjustment but these effects faded by Grade 5 (but they were marginally educationally meaningful). There are two likely explanations for these findings. Both parental involvement and teacher ratings were narrowly defined. Parent involvement was assessed by a single item; teacher ratings were assessed with six items of positive social and school adjustment. More comprehensive and refined measures may have yielded larger and more robust effects. Second, regarding parent involvement in school, continuous effects would not be expected throughout the schooling process, since parents naturally become less involved in school as

children grow older. The lack of effects for special education placement, if not a true reflection of the intervention, may be due to the low incidence of placement across the sample.

Although children participating in the full intervention for at least five years performed significantly better than comparison-group children on several outcomes, their adjustment was not up to the level of the typical child nationally. Children who enrolled in the full intervention through Grade 3, for example, were on average one year behind the national average in reading comprehension and six months behind in mathematics in Grade 5. This finding is consistent with previous studies (Abelson et al., 1974; Horacek et al., 1987). But children participating in the full intervention did score one month above the average child in the Chicago Public Schools in reading and mathematics. This is notable because of the substantially higher rate of school poverty of children in this study (66%) as compared to the citywide average (42%). Moreover, the rate of retention for the full intervention group was below the national public-school average in Grades 3 and 5 (Meisels & Liew, 1991). Thus, while early childhood interventions should not be expected to bring most disadvantaged children's academic performance up to the level of their more advantaged peers, effects on grade retention show they can make meaningful differences in children's school adjustment and competence.

Study Strengths and Limitations

Among the methodological strengths that reinforce the present findings were (a) the relatively large sample sizes of the groups participating in the intervention, (b) the differential exposure of children to the intervention from which several contrasts were made, (c) tracing children up to two years following the intervention, and (d) the simultaneous consideration of multiple adjustment outcomes, including the rarely considered construct of parental school involvement. As a consequence of these features, generalizability of results to children in typical inner-city schools is enhanced, thus providing direct evidence of what may be expected from Head Start-type interventions with different lengths (Haskins, 1989).

The primary alternative explanation to the results of this study is that self-selection into the intervention program rather than the program caused the observed differences in children's adjustment. Although this interpretation is a possibility, as it is of all studies that lack random

assignment to treatment groups, several design features and results substantially limit the plausibility of the self-selection interpretation. First, the groups were well matched on several sociodemographic factors such as parent education, family income (i.e., eligibility for free lunch), parent expectations for educational attainment, age, and family size. Because parent expectations, parent education, and eligibility for free lunch were collected during the program -- thus may have been impacted by it -- their inclusion in the analyses corrects, to some extent, the effects of selection. Moreover, children grew up in similar low-income neighborhoods with high concentrations of poverty. If self-selection were present, differences on some of these factors would have been expected.

Second, school stability -- a plausible unmeasured factor -- was ruled out as an explanation of intervention effects, as the full intervention group significantly outperformed the school-stable comparison group on reading achievement, mathematics achievement, and grade retention. This finding increases the likelihood that group differences were the result participation in the intervention. Moreover, analyzing data from many children in the present sample by latent-variable structural modeling, Reynolds (1992a) found no evidence that unmeasured variables biased the effect of preschool intervention on cognitive readiness at school entry, let alone change the interpretation of results. Because the greatest bias would have likely occurred at preschool entry, this finding extrapolates well across the intervention components.

Third, entry into the CPC program is based on educational and economic need, and schools often recruited families. Enrolled children were most likely to be in greatest need of the program. Consequently, the observed effects of the program may be underestimates rather than overestimates of true effects. The early studies of Head Start, for example, were found to underestimate program effects because comparison groups were drawn from less disadvantaged samples (Campbell & Erlbacher, 1970; Lee, Brooks-Gunn, & Schnur, 1988). The natural variation in exposure to intervention enabled comparisons among the six intervention groups irrespective of the nonCPC intervention group. Substantial differences in adjustment were found even among the intervention-only children.

Finally, the pattern of findings is inconsistent with the pattern expected if the self-selection hypothesis was true. If self-selection were present program effects would be relatively consistent over time, albeit inflated. To the contrary, the pattern of observed intervention effects varied substantially over time and by outcome. For example, effects on cognitive achievement in reading and math declined somewhat by Grade 5. Effects on teacher ratings and parental school involvement declined to the level of nonsignificance. Added to similar findings from many previous studies (Haskins, 1989; White, 1985), it is unlikely that selection contributed substantially to the findings of this study.

Of course, even if self-selection is not a plausible explanation for the findings of this study, results are not necessarily generalizable to the total population of young children or to other programs which differ in philosophy and scope. For example, like Head Start, the Child Parent Centers have had over 25 years of experience implementing the program which ensures a minimum level of program quality. Consequently, generalizability of the findings of this study is limited to relatively established programs which serve large proportions of low-income and minority populations.

Implications

Given that participation in the full intervention program appears to improve reading and mathematics achievement, and reduce the incidence of grade retention, a clear implication of this study is that early childhood interventions are most likely to be successful if they continue to Grade 2 or preferably Grade 3. One, two, and even three years of intervention, no matter when they are provided, had no effect on adjustment outcomes at the end of the program or up to two years afterwards. Consequently, early childhood intervention programs should instead focus on the implementation of continuous interventions from preschool to Grade 3 (Zigler, in press). Implementing extended early childhood programs shows a commitment to fostering the continuity of development of economically disadvantaged children who are frequently exposed to multiple stressors. By providing comprehensive and integrative services under the direction of school personnel and working directly with parents, children appear more likely to successfully negotiate the transition to the primary grades. Because parental school involvement was a source of site-to-

site differences in adjustment, efforts to improve family-school relations appear to be a tangible means of improving program effectiveness as well as children's school success.

What is the cost of three more years of intervention? For the CPC program it is approximately $10,500 per child (1991 dollars) or $3,500 annually. The costs of both the primary-grade and preschool programs are similar to or less than many other programs. For example, the annual cost (in 1991 dollars) per pupil of the CPC preschool program ($3,000) is similar to Head Start (Zigler & Muenchow, 1992), and is substantially lower than many other programs (Barnett & Escobar, 1990, p. 564). Combined with the primary-grade component, the CPC program appears to offer a cost-effective means of reducing the risk of school failure for a substantial number of children.

Continued follow-up of this sample will determine the stability of the intervention's effects. Indeed, evidence on long-term effectiveness across a range of outcomes is necessary to better understand what can be expected of typically implemented intervention programs for children at risk in inner-city schools. But studying the effectiveness of interventions, whatever their impact, should not come at the risk of giving less attention to the multiple influences on school adjustment. As contemporary studies are increasingly finding, successful adjustment is the result of a complex array of factors working in concert rather than one or two factors working in isolation. Early childhood intervention is only the beginning of a process of adjustment, and this process must be continuously supported.

Footnotes

I thank the Department of Research, Evaluation and Planning of the Chicago Public Schools for cooperation in data collection. I especially thank Jeanne Borger, Nikolaus Bezruczko, Mavis Hagemann, and Nancy Mavrogenes for their help in data collection and analysis, and their suggestions. I further appreciate the comments and suggestions of Edward Zigler and Ann Crouter on earlier versions of this paper.

1. For example, 51% of the original sample were girls compared to 52% in Grade 5; 68% of the original sample enrolled in preschool compared to 70% of the Grade 5 sample. Mean reading readiness scores (Iowa Tests of Basic Skills) in kindergarten for both groups was 1.1 grade equivalents. To be included in the Grade 5 sample, the following three conditions had to be satisfied: (a) children must have a valid identification number, (b) they must have been active in the Chicago Public Schools in kindergarten, and at least two years from Grade 3 to 5, and (c) they could not have more than seven missing test scores from kindergarten to Grade 5 (13 reading and mathematics scores were possible). Test scores of children satisfying these three conditions were assigned scores on the basis of their preschool participation and grade level. The number of imputations for each test score was less than 30 in any one year. Consequently, the variances and correlations of test scores were unaffected.

2. Inclusion of Head Start and Follow Through children was beyond the scope of the present study -- to evaluate the CPC Intervention Program. Neither group was representatively sampled. Head Start/Follow Through children were substantially less academically and socially adjusted than the nonCPC comparison group, of which they would have been a part. Their mean reading and mathematics achievement test scores at the end of the program were, respectively, 86.0 and 92.7; their rate of grade retention was 34.2%. Including them as part of the comparison group would have increased rather than decreased the estimated effects of the program. These low scores may be due to the fact that these children did not constitute a representative sample of Head Start children in Chicago. Hispanic children had, on average, higher scores on adjustment outcomes than black children. At the end of the program their mean reading achievement was 97.6 and math achievement = 101.8; their rate of grade retention was 18.3%. Separate analysis indicated their inclusion would have not affected estimates of intervention effects.

3. These seven groups include 1,052 children; the remaining 54 children were in kindergarten or primary-grade only interventions and did not fit into the groups. Preliminary analyses included both samples; primary analyses included only the 1,052 children.

4. Reynolds (1992a), in a study of mediators of preschool intervention, found no evidence of selection bias into CPC and comparison groups that influenced academic adjustment. The analyses were based on latent-variable structural modeling techniques.

5. A dummy variable was created for each one (1 = missing, 0 = complete) and entered as a covariate in the analysis (without the parent variables present). Coefficient estimates were in all cases statistically insignificant.

6. Because they were significantly associated with adjustment outcomes, the control variables were generally effective in removing variance in adjustment due to individual and family sociodemographic factors. For example, they were associated as follows with Grade 3 reading achievement: sex (1 = girls, 0 = boys; r = .15), parent education (r = .17), eligibility for lunch subsidy (r = .16), parent expectations (r = .27), school SES (r = .09), kindergarten age (r = .07), and number of siblings (r = -.04). These factors were used in multiple regression via analysis of covariance.

7. Their program PRELIS (Preliminary LISREL; Joreskog and Sorbom, 1988) computes correlations not as a pair of observed scores but as the "correlation between two latent variables n and e underlying y and x, where n and e are assumed to have a bivariate distribution" (p. 1 - 24). Joreskog and Sorbom (1988) found that these latent-variable correlations yielded the most accurate estimate of linear association for ordinal variables.

8. For example, their adjusted means for reading achievement in Grades 3 and 5 were, respectively, 93.2 and 105.4; For grade retention, mean percentage rates were 34.5 and 40.4.

9. The critical assumption of analysis of covariance is homogeneity of regression lines between intervention and comparison groups (Cohen & Cohen, 1983), and it was affirmed in the study.

10. Pooled standard deviations for Grades 3 to 5, respectively, were as follows: reading achievement (15.83, 15.45, 16.84), math achievement (12.90, 12.94, 15.03), teacher ratings (5.31, 5.36, 5.38), grade retention (0.39, 0.41, 0.43), parental school involvement (1.19, 1.17, 1.28), and special education placement (0.26, 0.29, 0.31). Effect sizes for grade retention and special education placement were adjusted for their binary-coded properties (Glass et al., 1981).

11. The effect of the full intervention was estimated as the difference in adjusted means between the full intervention group and the nonCPC comparison group. The primary-grade intervention effect was based on analysis of covariance via multiple regression with years of primary-grade intervention as the independent variable and the sociodemographic variables, end-of-kindergarten reading achievement and mathematics achievement as covariates. Only children participating in the CPC intervention were included in the analysis to determine the effect size of the primary-grade component. The effect of preschool was estimated as the difference between the effect sizes of the total intervention and the primary-grade component (i.e., [PS + PG] - PG).

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Table 1

Description of Child and Family Sociodemographic Factors for Intervention Groups

Intervention group	N	Proportions				Means		
		Girls	H S graduate	Lunch subsidy	Expect college	School SES	Kind Age	N of Siblings
With Follow-on								
1. PS + KG + PG-3	160	56	68	95	52	37.63a	63.84	2.16
2. No PS + KG + PG-3	76	49	66	95	51	34.18	63.78	2.26
3. PS + KG + PG-2	302	52	60	90	58	31.55ab	63.30	2.27
4. No PS + KG + PG-1/2	36	31	67	100	42	35.86	63.88	2.83
5. PS + KG + PG-1	80	53	55	97	54	36.25b	62.58	2.29
Without Follow-on								
6. PS + KG only	207	56	56	94	48	32.84a	62.85	2.40
7. NonCPC comparison group	191	53	55	90	44	31.06ab	63.80	2.78

Note. Total N = 1052. Ns for parent education and lunch subsidy, and parent expectations were, 758 and 751, respectively. The proportion of children missing data on these parent variables did not differ among groups and ranged from 23% to 33%. PS = preschool, KG = kindergarten, PG = primary-grade, CPC = Child Parent Center. H S = high school. Expect college = parent expects child to graduate from college (coded from 1 to 4 in analyses). Lunch subsidy = full or reduced.

All proportions were not significantly different from one another based on chi square tests ($p > .05$, $df(6)$).

Differences among means were based on analysis of variance. With the exception of school SES , no significant differences were found among groups. Post hoc analyis (Scheffe method) revealed these differences for school SES:

a = 1 > 2, 1 > 4, and 1 > 7.
b = 3 > 2 and 3 > 7.

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Table 2

Adjusted Means of CPC intervention and comparison groups for 6 outcomes at the end of the program (Grade 3) controlling for Sociodemographic Factors

Group	Reading achiev	Math achiev	Teacher ratings	Parent inv	Grade retent	Spec ed
CPC intervention (all)	94.6**	99.9**	18.8	2.5*	19.2***	7.8
Comparison	90.6	96.5	18.5	2.2	26.2	8.9

Note. N = 915 for CPC group, N = 191 for comparison group. Differences for grade retention and special education placement are cumulative proportions and were based on logistic regression analysis. Sociodemographic control factors = sex, parent education, eligibility for lunch subsidy, parent expectations, school SES in kindergarten, kindergarten age, and number of siblings.

*p < .05
**p < .01
***p < .001

Table 3
Means and Adjusted Means of Intervention Groups for Reading Achievement, Mathematics Achievement, Teacher Ratings, and Parental School Involvement Over Time

Intervention group	N	End of Program		1-year Follow-up		2-year Follow-up	
		Mean	Adj Mean	Mean	Adj Mean	Mean	Adj Mean
Reading achievement							
With Follow-on							
PS + KG + PG-3	160	103.1	102.2*	108.5	107.7*	117.8	116.8*
No PS + KG + PG-3	76	100.1	100.3*	102.4	102.6	111.7	112.0
PS + KG + PG-2	302	95.9	95.1*	104.2	103.2*	115.7	114.7*
PS + KG + PG-1	80	91.7	92.0	102.0	102.1	109.2	109.5
Without Follow-on							
PS + KG only	207	90.7	91.4	100.7	101.1	109.0	109.7
NonCPC comparison group	191	90.6	90.8	99.4	99.6	109.8	109.9
Mathematics achievement							
With Follow-on							
PS + KG + PG-3	160	106.6	106.1*	111.8	111.5*	123.0	122.4*
No PS + KG + PG-3	76	102.8	102.9*	109.6	109.7	118.9	119.0
PS + KG + PG-2	302	100.8	100.0*	110.4	109.4*	120.5	119.5*
PS + KG + PG-1	80	97.2	97.7	106.7	107.1	115.7	116.1
Without Follow-on							
PS + KG only	207	97.1	97.8	106.8	107.2	116.6	117.2
NonCPC comparison group	191	96.5	96.6	105.3	105.3	115.2	115.4
Teacher ratings of adjustment							
With Follow-on							
PS + KG + PG-3	151	20.6	20.3*	20.0	20.1*	19.8	19.3
No PS + KG + PG-3	65	19.2	19.2	18.4	18.6	17.9	17.9
PS + KG + PG-2	276	19.0	18.8	19.7	19.5	19.6	19.3
PS + KG + PG-1	64	18.8	18.9	18.0	18.3	18.6	18.5
Without Follow-on							
PS + KG only	178	18.2	18.3	18.6	18.7	18.1	18.1
NonCPC comparison group	171	18.5	18.7	18.5	18.4	18.5	18.3
Parental school involvement							
With Follow-on							
PS + KG + PG-3	145	3.0	3.0*	2.6	2.6	2.6	2.5
No PS + KG + PG-3	62	2.3	2.3	2.3	2.3	2.3	2.2
PS + KG + PG-2	266	2.7	2.7*	3.0	2.9*	2.8	2.7
PS + KG + PG-1	62	2.5	2.5	2.4	2.4	2.6	2.6
Without Follow-on							
PS + KG only	172	2.4	2.4	2.4	2.4	2.3	2.3
NonCPC comparison group	159	2.2	2.3	2.4	2.4	2.5	2.5

Note. PS = preschool, KG = kindergarten, PG = primary grade, CPC = child parent center.
* $p < .05$ relative to NonCPC comparison group.

Table 4

Unadjusted and Adjusted Rates of Intervention Groups for Grade Retention and Special Education Placement Over Time

Intervention group	N	End of Program %	End of Program Adj %	1-year Follow-up %	1-year Follow-up Adj %	2-year Follow-up %	2-year Follow-up Adj %
				Grade Retention			
With Follow-on							
PS + KG + PG-3	160	6.3	6.6*	12.5	11.8*	13.8	15.3*
No PS + KG + PG-3	76	13.2	12.3*	21.1	18.7	27.6	27.3
PS + KG + PG-2	302	15.0	16.9*	16.9	17.3*	20.9	22.8*
PS + KG + PG-1	80	23.8	22.0	27.5	24.9	31.3	30.6
Without Follow-on							
PS + KG only	207	27.5	25.7	27.5	25.0	32.4	31.8
NonCPC comparison group	191	26.2	26.0	27.8	25.9	31.4	31.3
				Special Education Placement			
With Follow-on							
PS + KG + PG-3	160	10.0	10.9	10.0	10.5	11.9	12.5
No PS + KG + PG-3	76	6.6	6.8	14.5	14.4	14.5	14.4
PS + KG + PG-2	302	5.3	5.3	5.6	5.7*	6.3	6.3*
PS + KG + PG-1	80	8.8	9.0	11.3	11.2	13.8	13.8
Without Follow-on							
PS + KG only	207	4.4	4.2	8.7	8.4	10.6	10.6
NonCPC comparison group	191	8.9	8.3	11.0	10.5	11.5	10.9

Note. PS = Preschool. KG = kindergarten. PG = primary grade.

* $p < .05$ relative to NonCPC comparison group.

Table 5

Means and Adjusted Means of the Full-intervention group and School-stable comparison group for Reading Achievement, Mathematics Achievement, and Grade Retention

Intervention group	N	End of Program		1 year follow-up		2 year follow-up	
		Mean	Adj Mean	Mean	Adj Mean	Mean	Adj Mean
				Reading achievement			
PS + KG + PG-3	160	103.1	102.3***	108.5	107.9**	117.8	116.9*
School-stable comparison	93	93.0	92.7	100.5	100.3	112.5	111.6
				Math achievement			
PS + KG + PG-3	160	106.6	106.1***	111.8	111.6*	123.0	122.5*
School-stable comparison	93	98.8	98.7	106.9	106.6	117.4	117.3
				Grade retention (values are percents)			
PS + KG + PG-3	160	6.3	6.4***	12.5	11.4***	13.8	15.3**
School-stable comparison	93	17.2	20.2	19.4	20.1	20.4	24.0

Note. PS = preschool, KG = kindergarten, PG = primary grade.

*p < .05
**p < .01
***p < .001 (all tests a priori one-tailed)

Table 6

Mean Performance of Children Participating in the Full Intervention By School

	School factor		Grade 5 outcome				
School	Poverty index	Parent inv	Reading achiev	Math achiev	Teacher ratings	Grade retent	Spec ed
School 1	61.8	3.6	123.2	125.8	17.2	4.8	19.1
School 2	72.1	3.5	119.5	124.6	20.3	5.6	13.9
School 3	56.1	3.1	117.5	123.5	21.5	33.3	7.4
School 4	55.0	2.8	114.8	121.0	22.8	25.0	4.2
School 5	68.0	2.5	107.1	117.8	17.1	16.7	16.7
School 6	59.8	2.4	113.2	119.1	19.8	5.3	5.3

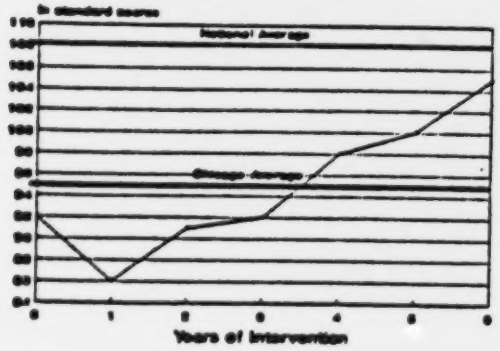
Note. Poverty index = percent of poor families in school region. Parent inv = parental school involvement and is reported as average of teacher ratings for all study children. Values for grade retention and special education placement are percents.

Figure Captions

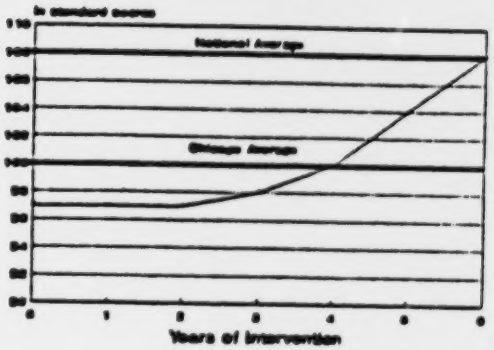
Figure 1. End-of-Program (Grade 3) Outcomes by Duration of CPC Intervention.

Figures 2. Effect Sizes of Intervention Components.

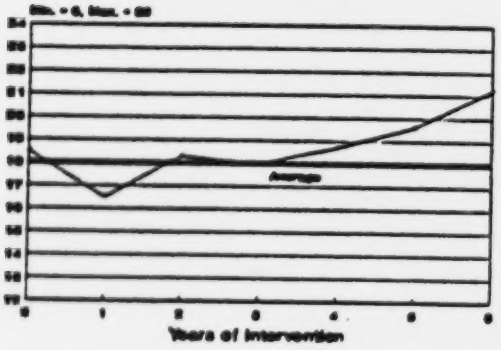
Reading Achievement



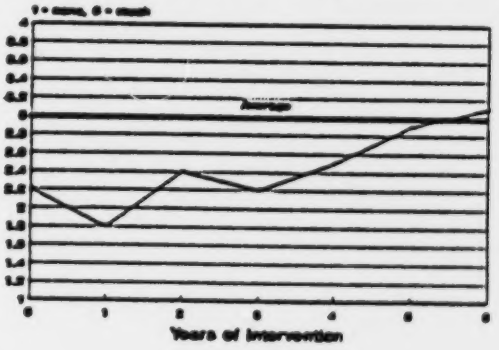
Math Achievement



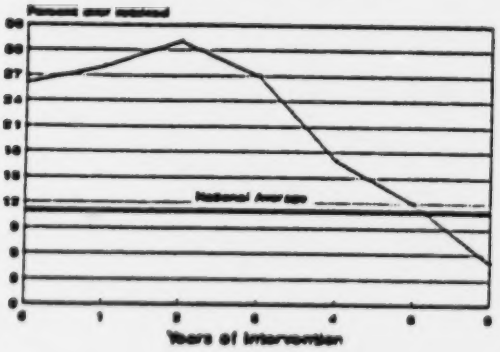
Teacher ratings



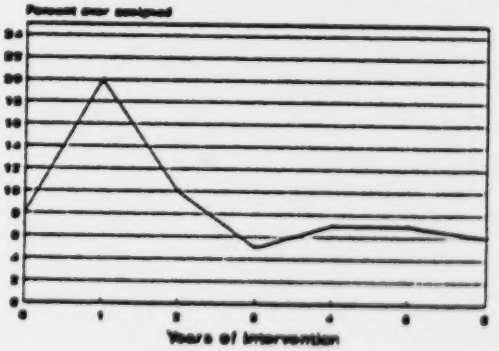
Parental School Involvement



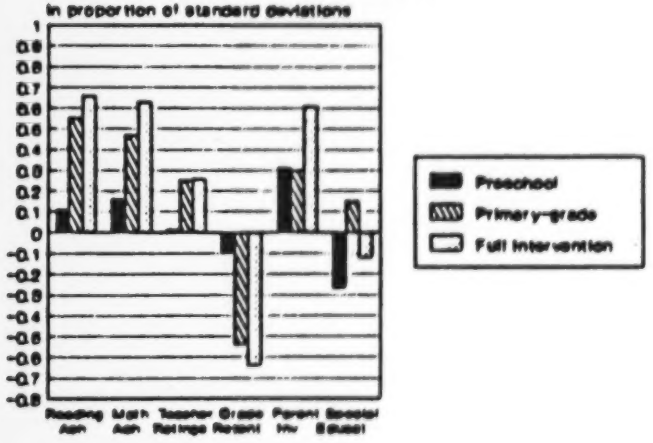
Grade Retention



Special Education Placement



Grade 3 Outcomes



Grade 5 Outcomes